PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of: Richard Anthony Brooks	
Serial No. 10/520,499	Examiner Donald W. Underwood
Filed: 1/7/2005	Group Art Unit 3652
Confirmation No. 2599	Attorney Docket 1-25801
For: Control System For A Load Handling Apparatus	

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SUBSTITUTE APPEAL BRIEF

Honorable Sir:

This is an appeal of the Examiner's final rejection dated March 4, 2008. This brief is in furtherance of a Notice of Appeal filed with an extension of time on July 7, 2008. Please charge the fees required under 37 C.F.R. §41.20(b)(2), any fees required for an extension of time for filing this brief, and any other necessary fees to MacMillan, Sobanski & Todd, LLC, Deposit Account No. 13-0005.

For the reasons set forth below, appellant request that the Board of Patent Appeals and Interferences reverse the Examiner as to all rejections.

No oral hearing is requested.

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I. Real Party In Interest

The real party in interest is J. C. Bamford Excavators Limited, the assignee of record.

II. Related Appeals And Interferences

There are no related appeals or interferences known to Appellants, the Appellants' representatives, or assignee which will directly affect, be directly affected by, or have a bearing on the Board's decision in this appeal.

III. Status Of Claims

Claims 1, 4-9, 12, 13, 16-21, 23 and 25 are currently pending in the application. Claims 2, 3, 10, 11, 14, 15, 22, 24 and 26-28 have been cancelled. All pending claims stand rejected. This is an appeal from the Examiner's final rejection of claims 1, 4-9, 12, 13, 16-21, 23 and 25.

IV. Status Of Amendments

No amendments have been filed after the final rejection.

V. Summary Of Claimed Subject Matter

The claimed invention is directed to a machine 10 including a load handling apparatus which includes a body 11 and a lifting arm 14 which is hydraulically movable about a horizontal axis B relative to the body for raising and lowering a load L upon operation of a fluid operated actuator 24. (see Figs. 1 and 2 and page 5, line 23 through page 6, line 7 of the published PCT application WO 2004/007339) The load produces a tipping moment

about a pivot C as the load is moved (page 6, lines 25-25). The tipping moment will increase as the load is lowered or extended which is due to the load moving outwardly from the body of the machine (page 7, lines 4-13). This can cause instability of the machine to the point where the apparatus tips over. A a sensor 30 and a controller 32 senses when the tipping moment is approaching a predetermined threshold value (page 7, lines 17-21) operates a proportional valve 42 (Fig. 3) to reduce the flow of fluid to the actuator so that the speed of movement of the load is progressively reduced as the threshold tipping moment is approached. Movement of the load may be stopped when the tipping moment threshold is reached. (page 8, line 9 to page 9, line 7)

If movement of the load carried by a prior art machine is suddenly stopped when the load is near the critical tipping moment, load inertia can cause the machine to tip over. As a consequence, a threshold tipping moment where the prior art machine is stopped has been set well within safety margins to allow for load inertia during movement changes. (page 1, line 13 to page 2, line 2) According to the claimed invention, the speed at which the load is moved is gradually decreased as the threshold tipping moment is approached so that movement of the load is not suddenly stopped when the threshold tipping moment is reached. The claimed invention allows the threshold tipping moment at which load movement is stopped to be set closer

to the critical tipping moment than with prior art machines, allowing a greater operating range of safe movement of the load.

According to one embodiment of the invention, fluid actuators are used to control normal movement of the load handling apparatus and additional fluid actuators are provided. When the load handling apparatus is stopped due to the sensed tipping moment reaching the threshold tipping moment, the additional fluid actuators may be operated to move the load handling apparatus in a direction which reduces the sensed tipping moment.

VI. Grounds Of Rejection To Be Reviewed On Appeal

The following issues are to be decided:

1. Whether claims 1, 4-9, 12, 13, 16-18, 23 and 25 are unpatentable over Pugh et al. patent 4,042,135 in view of Bach et al. patent 5,257,177.

2. Whether claims 19 and 20 are unpatentable over Pugh et al. patent 4,042,135 in view of Bach et al. patent 5,257,177 and Meyer et al. patent 4,822,237.

3. Whether claim 21 is unpatentable over Pugh et al. patent 4,042,135 in view of Bach et al. patent 5,257,177 and Wacht et al. patent 5,058,752.

VII. Statement Of Facts

Fact 1: Neither the first office action nor the final rejection point out any facts from the Pugh et al. patent 4,042,135 supporting the rejection. Fact

2: Pugh et al. teaches that it was known in at least as early as 1974 to use strain gauges to sense when the tipping moment on a machine which includes a load handling apparatus exceeds a predetermined level and to stop further telescoping movement of a load lifting arm (column 3, line 16 to column 4, line 4). Fact 3: Pugh et al. does not teach slowing down movement of a lifting arm as a predetermined tipping moment is approached. Fact 4: Bach et al. patent 5,257,177 is directed to controlling the movement of hydraulically movable work equipment, and to a path control arrangement which guarantees that the desired path of movement of the work equipment will be maintained (column 2, lines 33-38). Fact 5: Bach et al. teaches the use of proportioning valves V to control the flow of hydraulic fluid to cylinders to control movement of the work equipment. The valves V control the amount of hydraulic fluid which varied in dependence on an input signal (column 11, lines 1-14). Fact 6: Bach et al. does not sense a tipping moment on the machine or adjust the speed of movement of work equipment in response to a sensed tipping moment. Fact 7: Neither Pugh et al. nor Bach et al. teach a control system for a machine having a load handling apparatus in which a sensed tipping moment of the machine is compared with a threshold value and in which movement of the speed at which the load handling apparatus is moved is slowed down as the threshold value is approached. Fact 8: Neither Pugh et al. not Bach et al. teach a control system which gradually slows down

movement of a load handling apparatus as a sensed tipping movement approaches a threshold value at which time further movement is stopped, and which includes further actuators which may be operated to move the stopped load handling apparatus in a direction which will reduce the apparatus tipping moment. Fact 9: Meyer et al. patent teaches a load handling apparatus in which the attitude of the load is automatically maintained as the load is moved. Fact 10: Wacht et al. discloses a machine boom overload warning and control system including a time delay which prevents generation of a warning signal when the boom is experiencing only momentary overload conditions, such as when the boom bounces when carrying an acceptable sized load.

VIII. Arguments Of Patentability

A. Claim 1, 4-9, 12, 13, 16-18, 23 and 25 are patentable over Pugh et al. patent 4,042,135 and Bach et al. patent 5,257,177

The final rejection of claims 1, 4-9, 12, 13, 16-18, 23 and 25 has not provided any reasoning as to how applicants' invention would be obvious over Pugh et al. in view of Bach et al. Based upon the teachings of these patents, applicants' claimed invention was not obvious to one of ordinary skill in the art at the time applicants made their invention. There is no teaching, suggestion or motivation in the Pugh et al. and Bach et al patents to arrive at applicant's claimed invention. Controls of the type taught in Pugh et al. have been available in the industry since at least as early as the 1974 priority date

of the Pugh et al. patent. For many years, machines have been available which provides a warning or which stop movement before a critical tipping moment for the machine is reached. For safety purposes, these machines are set to stop movement well within safety margins to avoid any risk of the machines tipping over. Both manual and electric proportioning valves also have been used for controlling the flow of hydraulic fluid to and from cylinders for controlling movement of machine components. Although proportioning valves have been known to those skilled in the art, they were not used prior to applicants' invention for automatically limiting the speed that a machine element is moved with a hydraulic actuator. Although the this technology has been available for a long time, there has been no teaching, suggestion or motivation to progressively slow movement of load handling apparatus as a predetermined tipping moment is approached in order to provide a greater range of safe movement of the load handling apparatus. There is nothing in the art of record to suggest that the use of a proportioning valve in the Pugh et al. apparatus for controlling the speed at which its telescoping boom is moved could be controlled to extend the range in which the boom can be moved without a significant increase in the risk that apparatus would tip over. Nor is there any suggestion of controlling such a valve in a manner to slow down movement of the Pugh et al. boom as a threshold tipping moment is approached. Nor has the examiner presented any

reasoned argument as to how this would be obvious to a person of ordinary skill in the art.

Applicants have done more than merely substitute a known proportioning valve for the open/closed valve in Pugh et al. which is operated to stop movement of a boom or other load handling apparatus when a predetermined tipping moment is reached to yield a predictable result. In addition to using a proportioning valve, applicants system looks at a sensed tipping moment and at a predetermined threshold value of the tipping moment and progressively slows movement of the load handling apparatus as the sensed tipping moment approaches the threshold tipping moment. Since this is not taught in the applied prior art, applicants' claimed control system is not obvious.

Neither Pugh et al. nor Bach et al. is concerned with the concept of the claimed invention and neither recognize the problem addressed by the claimed invention. Pugh et al. does recognize that if the tipping moment of a load handling apparatus exceeds a critical value, the apparatus will tip over. Its solution to this problem is to stop movement well prior to the point where the apparatus will tip over. Bach et al. is concerned with movement of a load along a particular path such as a straight line. It is not concerned with the apparatus tipping over. Neither reference is concerned with the inertia of a load on a moving arm when movement of the load is stopped. The prior art

avoided this problem by stopping movement of the load at a point wherein the increase in the tipping moment due to the load is within a safe range less than the critical tipping moment. This limited the operating range of the apparatus. The prior art does not teach and persons of ordinary skill in the art have not recognized that the operating range of the apparatus can be increased without risk of tipping by slowing down movement of load handling apparatus as a predetermined threshold tipping moment is approached, even though the Pugh et al. prior art has been available for over 35 years.

Claim 18 also includes a limitation that the system includes a plurality of actuators that the controller prevents the flow of fluid to raising and lowering actuators when the tipping moment reaches the threshold moment, and that further actuators can be operated to perform a correctional operation which will result in a reduction in the tipping moment. There is no teaching in either Pugh et al. or Bach et al. of actuators similar to the claimed additional actuators.

Consequently, applicants' claimed invention is patentable over Pugh et al. and Bach et al. and the rejection of claims 1, 4-9, 12, 13, 16-18, 23 and 25 should be reversed.

B. Claims 19 and 20 are patentable over Pugh et al. patent 4,042,135, Bach et al. patent 5,257,177 and Meyer et al. patent 4,822,237

Claim 19 and 20 are dependent on claims 8 and 1 and is patentable over Pugh et al. and Bach et al. for the reasons discussed above. Claims 19 and 20 further include that the attitude of lifting forks on the apparatus is maintained relative to the ground as the lifting forks are moved. Meyer et al. is not concerned with operating apparatus near a threshold tipping moment, or with increasing the operating range of the apparatus by slowing down movement of the apparatus as the threshold tipping moment is approached. Since Meyer et al. does not cure the failure of Pugh et al. and Bach et al. to teach the control system of claims 1 and 8, claims 19 and 20 are patentable and the rejection should be reversed.

C. Claim 21 is patentable over Pugh et al. patent 4,042,135, Bach et al. patent 5,257,177 and Wacht et al. patent 5,058,752

Claim 21 is dependent on claim 1 and is patentable over Pugh et al. and Bach et al. for the reasons discussed above. Since Wacht et al. does not cure the failure of Pugh et al. and Bach et al. to teach the control system of claim 1, claim 21 also is patentable and the rejection should be reversed.

For the above reasons, it is respectfully submitted that the Examiner's final refusal to allow claims 1, 4-9, 12, 13, 16-21, 23 and 25 was incorrect.

Accordingly, it is requested that the Examiner's final rejection be reversed.

Respectfully submitted,

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IX. Claims Appendix

1. A control system for a machine which includes a load handling apparatus, the load being moveable relative to a body of the machine by the load handling apparatus, the load handling apparatus being a lifting arm which is moveable about a generally horizontal axis relative to the body of the machine, the arm thus being capable of raising and lowering the load upon operation of a fluid operated actuator the machine including a pivot about which a tipping moment is produced by the load, the load handling apparatus being capable of lowering the load to a position at which the tipping moment is at a predetermined threshold value, the control system including a sensor to sense when the value of the tipping moment is approaching the threshold value and to provide an input to a controller in response, the controller being responsive to the input to operate a proportional valve to reduce the flow of fluid to the actuator so that the speed of movement of the load is progressively reduced as the lifting arm is continued to be lowered.

2. (cancelled)

3. (cancelled)

4. A system according to claim 1 wherein the lifting arm includes a plurality of relatively moveable sections, and the controller influences operation of a second actuator which relatively moves the arm sections as the tipping moment approaches the threshold value.

5. A system according to claim 4 wherein the relatively moveable sections are telescopic.

6. A system according to claim 1 wherein the arm carries a load handling implement which is movable on the arm by operation of a third actuator and the controller influences operation of the third actuator as the tipping moment approaches the threshold value.

7. A system according to claim 6 wherein the load handling implement is a loading forks.

8. A system according to claim 1 wherein the speed of movement of the load is progressively reduced and is stopped altogether when the tipping moment is at the threshold value.

9. A system according to claim 1 wherein the machine includes a ground engaging structure by which the machine is supported on the ground the ground engaging structure including a pair of supports, the tipping moment being produced about a pivot axis established by one of the supports, the tipping moment being sensed by the sensor sensing loading of one of the supports.

10. (cancelled)

11. (cancelled)

12. A system according to claim 9 wherein the machine is a wheeled load handling machine having a ground engaging structure including a pair of supports provided by axles which each carry wheels.

13. A system according to claim 12 wherein the tipping moment is produced about a rotational axis of one of the pairs of wheels and the sensor senses the loading on the other pair of wheels.

14. (cancelled)

15. (cancelled)

16. A system according to claim 1 wherein the fluid operated actuator is a double acting linear hydraulic ram.

17. A system according to claim 1 wherein the sensor is a transducer which provides an electrical input signal to the controller.

18. A system according to claim 8 wherein the load handling apparatus includes a plurality of actuators, and in the event that the controller prevents the flow of fluid to or from the raising and lowering actuator if the tipping moment value reaches the threshold value, the controller permits one or more of the further actuators to be operated to perform a correctional operation which will result in a reduction in the tipping moment.

19. A system according to claim 18 wherein where the load handling implement is a lifting forks, and during any permitted correctional actuator

operation, the attitude of the lifting forks relative to the ground is automatically maintained.

20. A system according to claim 19 wherein the machine includes a displacement actuator which is operated as the lifting arm is raised and lowered to exchange fluid with an actuator which controls the attitude of the load handling implement relative to the ground, and during correctional actuator operation, when the raising and lowering actuator is isolated, fluid pressure in a circuit containing the attitude controlling and displacement actuators is maintained.

21. A system according to claim 1 wherein the controller operates according to an algorithm which enables the controller to ignore transient changes of loading sensed by the sensor as a result of changing machine dynamics or of reaction to initial lift arm movements.

22. (cancelled)

23. A machine having a control system which includes a load handling apparatus, the load being moveable relative to a body of the machine by the load handling apparatus, the load handling apparatus being a lifting arm which is moveable about a generally horizontal axis relative to the body of the machine, the arm thus being capable of raising and lowering the load upon operation of a fluid operated actuator the machine including a pivot about which a tipping moment is produced by the load, the load handling

apparatus being capable of lowering the load to a position at which the tipping moment is at a predetermined threshold value, the control system including a sensor to sense when the value of the tipping moment is approaching the threshold value and, to provide an input to a controller in response, the controller being responsive to the input to operate a proportional valve to reduce the flow of fluid to the actuator so that the speed of movement of the load is progressively reduced as the lifting arm is continued to be lowered.

24. (cancelled)

25. A load handling apparatus controlled by a control system which includes a load handling apparatus, the load being moveable relative to a body of the machine by the load handling apparatus, the load handling apparatus being a lifting arm which is moveable about a generally horizontal axis relative to the body of the machine, the arm thus being capable of raising and lowering the load upon operation of a fluid operated actuator the machine including a pivot about which a tipping moment is produced by the load, the load handling apparatus being capable of lowering the load to a position at which the tipping moment is at a predetermined threshold value, the control system including a sensor to sense when the value of the tipping moment is approaching the threshold value and, to provide an input to a controller in response, the controller being responsive to the input to operate a

proportional valve to reduce the flow of fluid to the actuator so that the speed of movement of the load is progressively reduced as the lifting arm is continued to be lowered.

26. (cancelled)

27. (cancelled)

28. (cancelled)

X. Claim Support and Drawing Analysis

Claim 1: A control system {Fig. 3 #40, Page 8, line 7 to Page 9, line 7} for a machine {Fig. 1 #10} which includes a load handling apparatus {Fig. 1 #26}, the load {Fig. 1 #L} being moveable relative to a body {Fig. 1 #11} of the machine {10} by the load handling apparatus {26}, the load handling apparatus being a lifting arm {Fig. 1 #14} which is moveable about a generally horizontal axis {Fig. 1 #B} relative to the body {11} of the machine {10}, the arm {14} thus being capable of raising and lowering the load {L} upon operation of a fluid operated actuator {Fig. 1 #24}, the machine including a pivot {Fig. 1 #C, Page 6, last ¶} about which a tipping moment is produced by the load {L}, the load handling apparatus being capable of lowering the load to a position at which the tipping moment is at a predetermined threshold value {Page 7, lines 4-13}, the control system including a sensor {Fig. 1 #30, Page 7, line 17} to sense when the value of the tipping moment is approaching the threshold value {Page 7, line 14} and to provide an input to a controller {Fig. 1 #32, Page 7, lines 17-21} in response, the controller {32} being responsive to the input to operate a proportional valve {Fig. 3 #42} to reduce the flow of fluid to the actuator {24} so that the speed of movement of the load is progressively reduced as the lifting arm is continued to be lowered {Page 8, line 6 to Page 9, line 17}.

Claim 19: A system according to claim 18 wherein where the load handling implement is a lifting forks {Fig. 1 #26}, and during any permitted correctional actuator operation, the attitude of the lifting forks relative to the ground is automatically maintained {Page 10, lines 22-27}.

Claim 21: A system according to claim 1 wherein the controller {Fig. 1 #32} operates according to an algorithm which enables the controller to ignore transient changes of loading sensed by the sensor as a result of changing

machine dynamics or of reaction to initial lift arm movements {Page 11, l22 to Page 12, line 2}.

Claim 23: A machine {Fig. 1 #10} having a control system which includes a load handling apparatus {Fig. 1 #26}, the load {Fig. 1 #L} being moveable relative to a body {Fig. 1 #11} of the machine by the load handling apparatus, the load handling apparatus being a lifting arm {Fig. 1 #14} which is moveable about a generally horizontal axis {Fig. 1 #B} relative to the body {11} of the machine {10}, the arm thus being capable of raising and lowering the load upon operation of a fluid operated actuator {24} the machine including a pivot {Fig. 1 #C, Page 6, last ¶} about which a tipping moment is produced by the load {L}, the load handling apparatus being capable of lowering the load to a position at which the tipping moment is at a predetermined threshold value {Page 7, lines 4-13}, the control system including a sensor {Fig. 1 #30, Page 7, line 17} to sense when the value of the tipping moment is approaching the threshold value and, to provide an input to a controller {32} in response {Page 7, lines 17-21}, the controller being responsive to the input to operate a proportional valve {Fig. 1 #42} to reduce the flow of fluid to the actuator so that the speed of movement of the load is progressively reduced as the lifting arm is continued to be lowered {Page 8, line 6 to Page 9, line 17}.

Claim 25: A load handling apparatus controlled by a control system {Fig. 3 #40, Page 8, line 7 to Page 9, line 7} which includes a load handling apparatus {Fig. 1 #26}, the load {Fig. 1 #L} being moveable relative to a body {Fig. 1 #11} of the machine {Fig. 1 #10} by the load handling apparatus, the load handling apparatus {26} being a lifting arm {Fig. 1 #14} which is moveable about a generally horizontal axis {Fig. 1 #B} relative to the body {11} of the machine {10}, the arm thus being capable of raising and lowering the load upon operation of a fluid operated actuator {Fig. 1 #24},

the machine including a pivot {Fig. 1 #C} about which a tipping moment is produced by the load {L}, the load handling apparatus being capable of lowering the load to a position at which the tipping moment is at a predetermined threshold value {Page 7, lines 4-13}, the control system including a sensor {Fig. 1 #30, Page 7, line 17} to sense when the value of the tipping moment is approaching the threshold value {Page 7, line 14} and, to provide an input to a controller {Fig. 1 #32, Page 7, lines 17-21} in response, the controller being responsive to the input to operate a proportional valve {Fig. 1 #42} to reduce the flow of fluid to the actuator so that the speed of movement of the load is progressively reduced as the lifting arm is continued to be lowered {Page 8, line 6 to Page 9, line 17}.

XI. Evidence Appendix

None

XII. Related Decisions Appendix

None